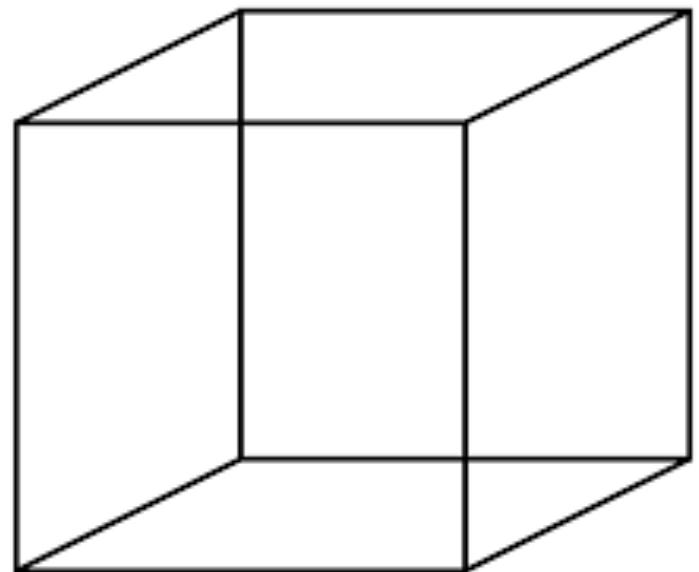


# PSYCHOLOGY 305

# COGNITIVE PROCESSES

## Consciousness and Free Will

1. Intro
2. Consciousness
3. Free Will



# Terri Schiavo, PVS, & Consciousness



Severe brain atrophy (2002)  
Flat EEG



**Most Neurologists agreed Terri was in PVS (Bernat, 2005)**  
**No evidence for consciousness in PVS At that time**

# Terri Schiavo, PVS, & Consciousness

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- Consciousness in a persistent vegetative state (PVS) patient?
- Most notable & complex controversies in American legal and political history involving Neurology & Neuroscience
  - 14 appeals and numerous motions, petitions, and hearings in the Florida courts
  - five lawsuits in federal district court
  - Florida legislation struck down by the Supreme Court of Florida
  - Federal legislation (the Palm Sunday Compromise) signed by President Bush at 1:11 a.m.
  - four denials of certiorari from the Supreme Court of the United States.
- How to define death
  - Biological standard: heart and lungs stopped working permanently
  - The Harvard neurological standard: “entire brain,” including the brainstem, had irreversibly ceased to function (since 1968)

# Was Terri still Alive/Conscious?

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## Behavior without cortex

- Orienting with eye and head movements toward sights and sounds
- Generating facial expressions
- Producing nonverbal vocalizations
- None seen in Terri



# Was Terri still Alive/Conscious?

## Minimally conscious state (MCS)

X

1. ability to follow simple commands
2. gestural or verbal yes/no responses
3. intelligible verbalization
4. purposeful behaviors that are contingent upon and relevant to the external environment

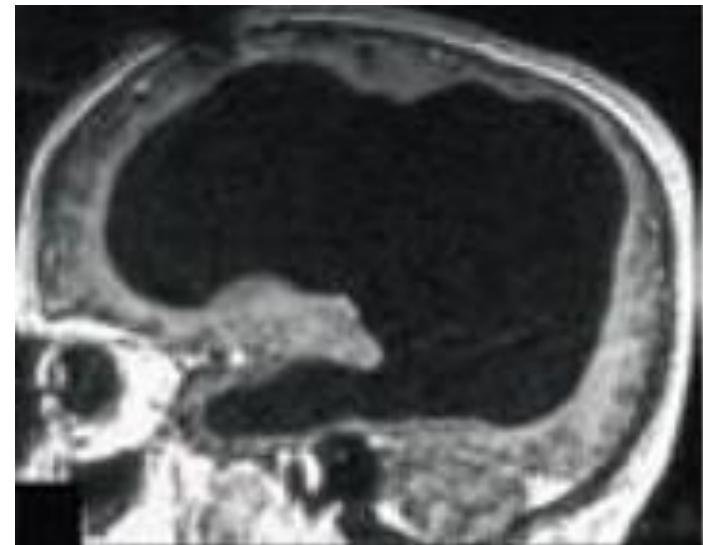


Terri: persistent vegetative state (PVS)

# Was Terri still Alive/Conscious?

## The man with a hole in his brain

- The whole brain was reduced - frontal, parietal, temporal and occipital lobes - on both left and right sides
- visually, it is more than a 50% to 75% reduction
- He was a married father of two children, and worked as a civil servant. On neuropsychological testing, he proved to have an intelligence quotient (IQ) of 75: his verbal IQ was 84, and his performance IQ 70



Terri



# Was Terri still Alive/Conscious?

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- Was her brain dead?
- Does Terri have conscious?
- “The conundrum with the vegetative state [and the absence of consciousness] is that it's a diagnosis made on lack of evidence”  
– Owen
- Evidence being???

Think, pair, share: how do we test for consciousness in Terri?

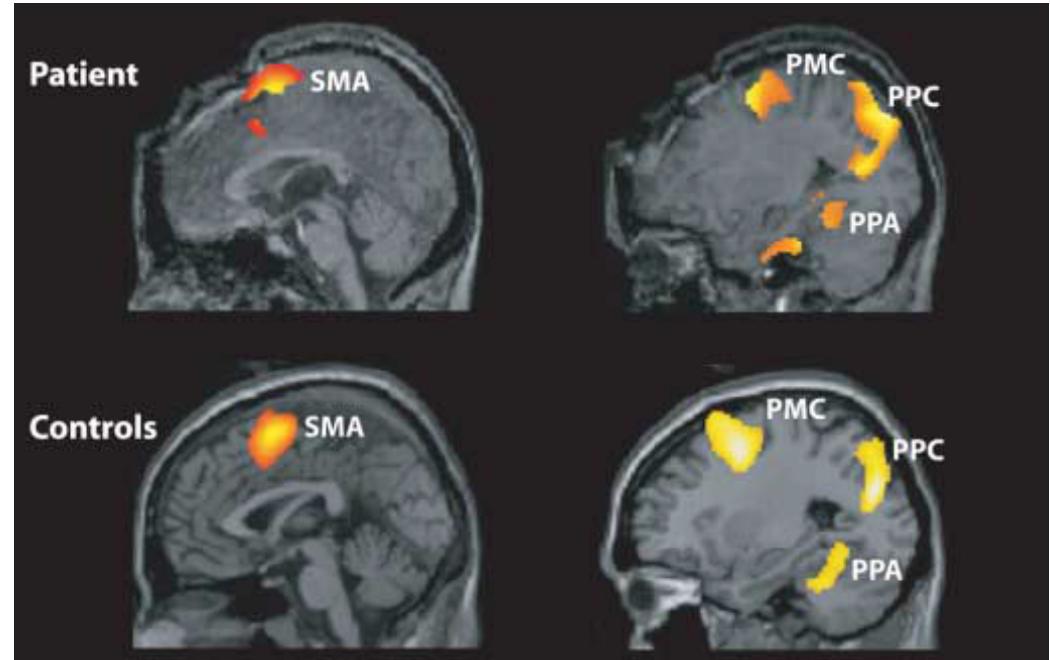
# PVS & Consciousness

To visualize

“Playing tennis”

“walking through your home”

1. Differential brain activities corresponding to the spoken command
2. Comparable to healthy subjects



Supplementary motor area

Parahippocampal place area  
posterior parietal cortex  
lateral premotor cortex

Able to understand spoken commands and to respond to them through her brain activity without speech or movement.

Owen et al (2006)

# Consciousness

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- It IS extremely difficult to assess conscious awareness
- But should we ask a different question first?
- What is consciousness?

# **What is Consciousness?**

The #1 issue in Cog Neuro

The Two Extremes:

**Metaphysics:** Cosmic consciousness or the “Mind of God”

“I” decide in a conscious and free way, I am responsible for my action

Popper & Eccles in “The Self and Its Brain” (1977) think that self can’t be just the brain, going back to the idea of souls animating bodies.

The illusion of “ghost in the machine”, or homunculus, is very strong.

**Determinism:** consciousness arises from chemical and electrical activity within the brain



# Pinker (1997)

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**Sentience:** This is the subjective experience, related to phenomenal awareness. It is only available to the individual having the experience

**Access to Information:** We have the ability to report the content of our experience, but not the processes producing the experience

**Self-knowledge:** We have the ability to be self aware.

*“I cannot only feel pain and see red, but think to myself, ‘Hey, here I am, Steve Pinker, feeling pain and seeing red!’”*

# *Functions of Consciousness*

Cognitive Activity:

Mental Events

Consciousness:

Awareness of  
Mental Events

Consciousness is us ‘looking’ at these internal processes and this neuronal workspace

- Dehaene & Naccache, 2001

# Dual-aspect theory

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Consciousness and brain activity are **one** process with **two** sides

- Objective – what we can detect from the outside
- Subjective – what we can tell someone else about our experience

A neuroscientist talks to a patient

I know something about your mental state that you do not (Its physical embodiment)

You know something about it I do not (Its manifestation in experience)

# Dual aspect theory

---

**Can physical states cause mental states?**

Psychoactive drugs would suggest so

**Can mental states cause physical states?**

Placebo effect & expectation effect would suggest so

# *Chalmers, 1995*

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## **Hard Problem of Consciousness**

*“Even when we have explained the performance of all the cognitive and behavioral functions in the vicinity of [conscious] experience - there may still remain a further unanswered question: Why is the performance of these functions accompanied by experience? Why doesn’t all this information processing go on in the dark, free from any feel”*

# Remains unanswered!

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How to explain our first person conscious experience (phenomenal conscious)

*Can this be explained?*

# How much information do we consciously see with a glimpse?

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Flash a photo

Introspect your mental image

- How much do you see?
- How detailed is it?



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Introspect your mental image

- How much did you see?
- How detailed was it?

# Phenomenal Experience

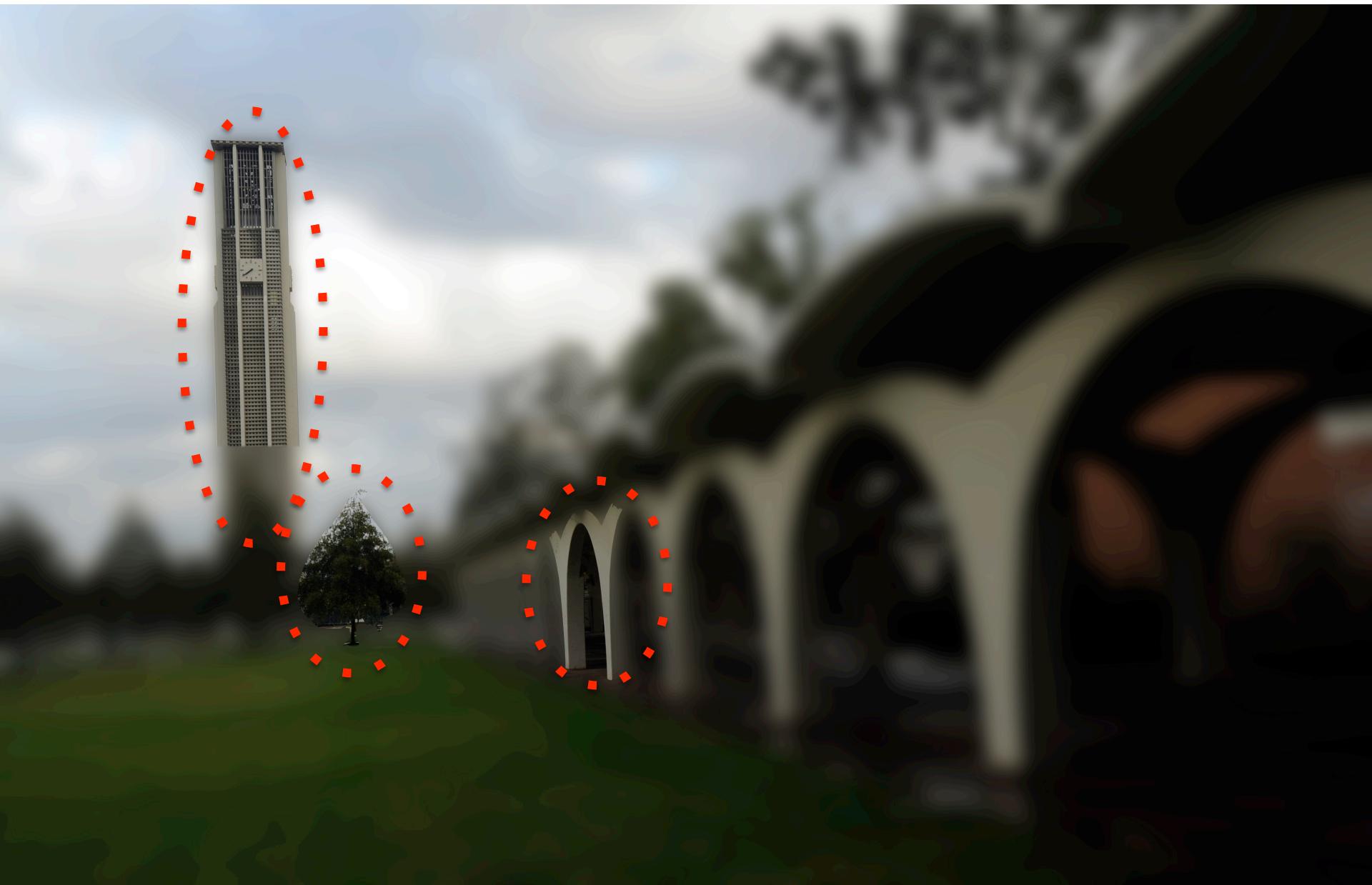


# Reality Check

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# Access conscious: A reality check



# The “Religion” in Vision

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## According to Ned Block

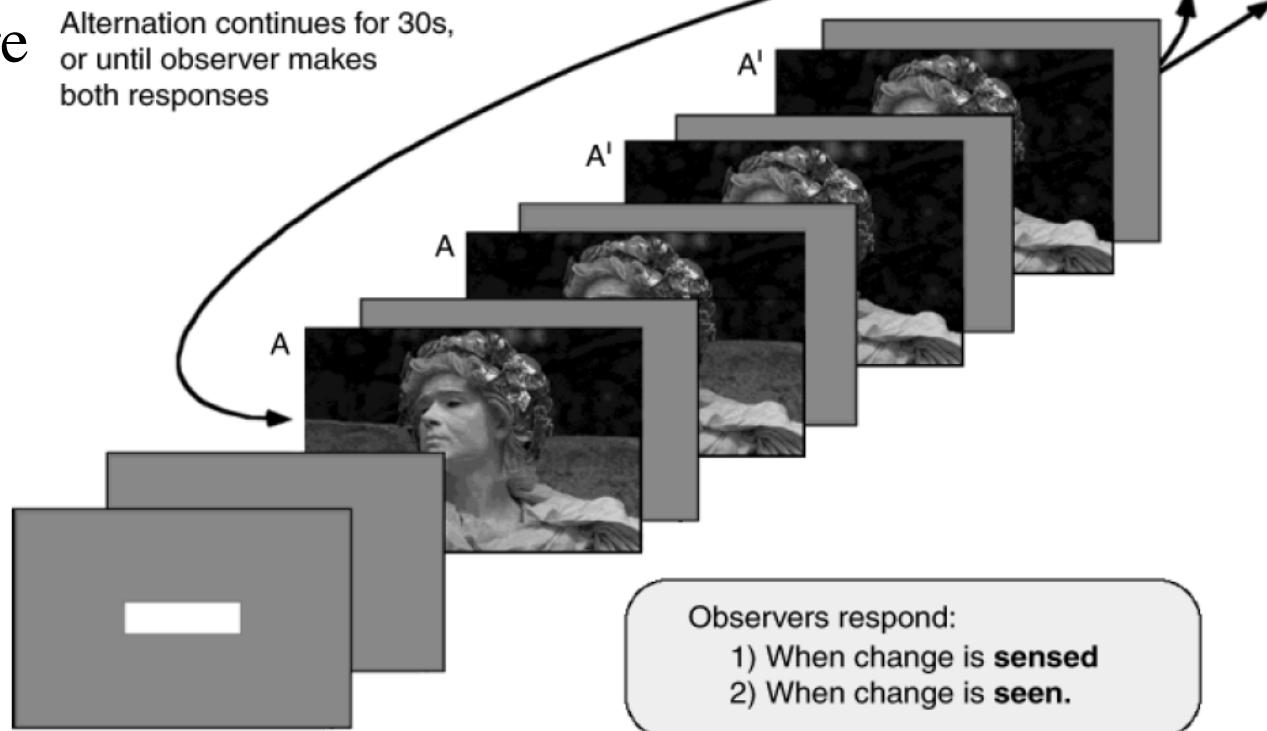
- Access conscious
  - reportable information
  - Rather limited, most likely from Short term memory
- Phenomenal conscious: “a continuous stream of rich and detailed sights”
  - Cannot be accessed or reported
  - Overflow based on iconic memory (Block, 2007; Rensink, 2004)
  - No, Grand Illusion of Vision (Dehaene, et al., 2006; Mitroff & Simons, 2002; Noe, 2002; O'Regan & Noë, 2001; Simons, et al., 2005)

# Phenomenal conscious without Access conscious?

Sensing can occur before seeing (i.e., Sensing without seeing)

Is this mindset or six sense?

Rensink (2004)



## Alternatively

- Response bias (Simon et al., 2005): conservative for seeing but liberal for sensing
- Familiarity versus recollection (Aly & Yonelinas, 2012)



# PSYCHOLOGY 305

# COGNITIVE PROCESSES

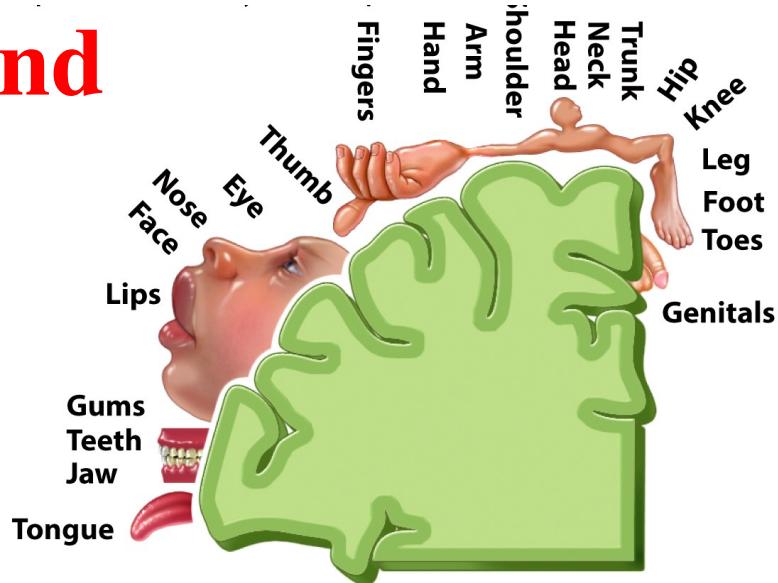
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Consciousness and Free Will, and the Law

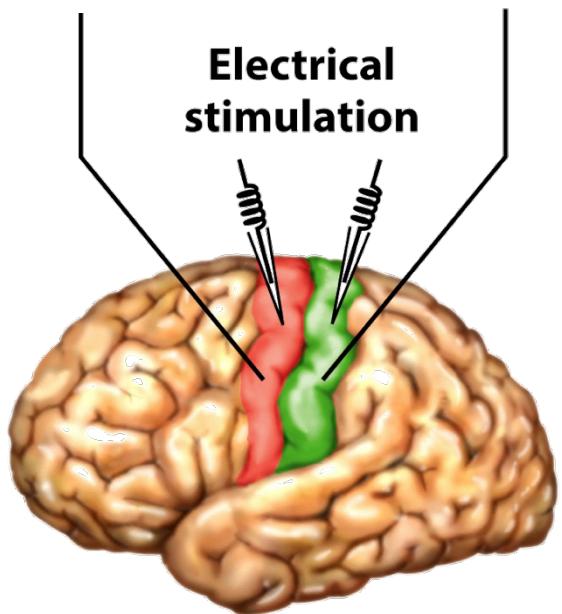
1. Intro
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# Brain gives rises to mind

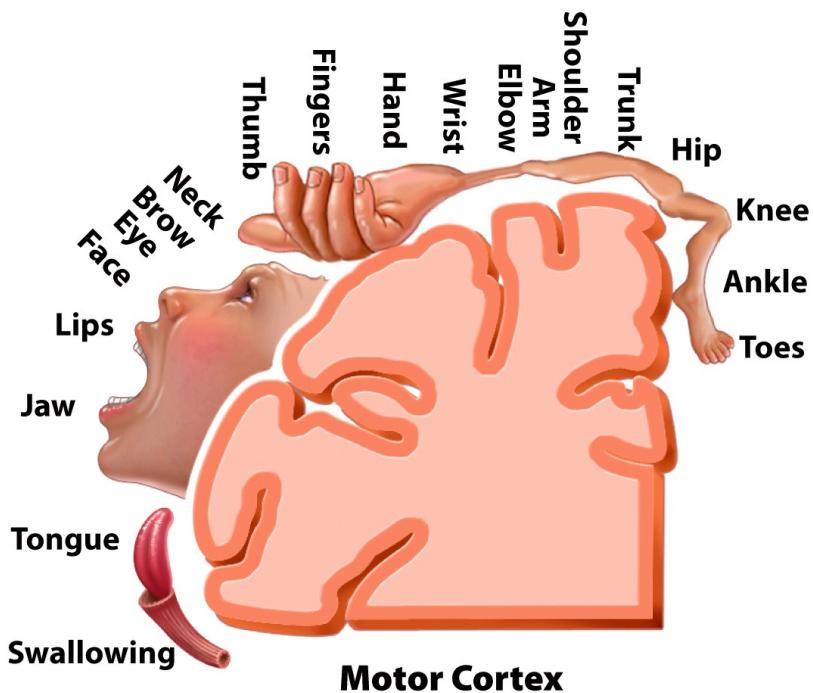
Week 1



**Somatosensory Cortex**



**Somatosensory cortex:  
somatic sensation**



**Motor Cortex**

# Brain gives rises to mind

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Who is the Boss?!

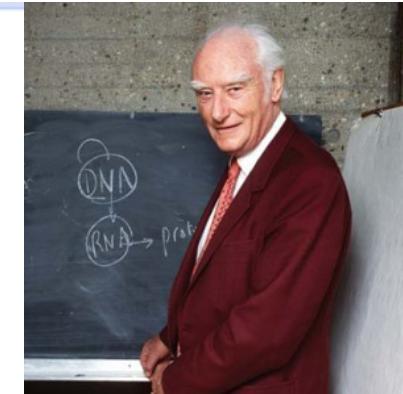
Do we have Free Will?

Are we the slaves of our brains?

- Visual illusion
- Jennifer Aniston neuron
- Political brain
- Inattentional blindness
- Creating/erasing memories
- “True love”
- Cognitive control and PFC

# Determinism

- ❑ Neural Correlates of Consciousness (NCC)
  - “...you, your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of **a vast assembly of nerve cells and associated molecules.**  
**You’re nothing but a pack of neurons.”**
- Francis Crick, Nobel Prize winner in Physiology or Medicine, 1962

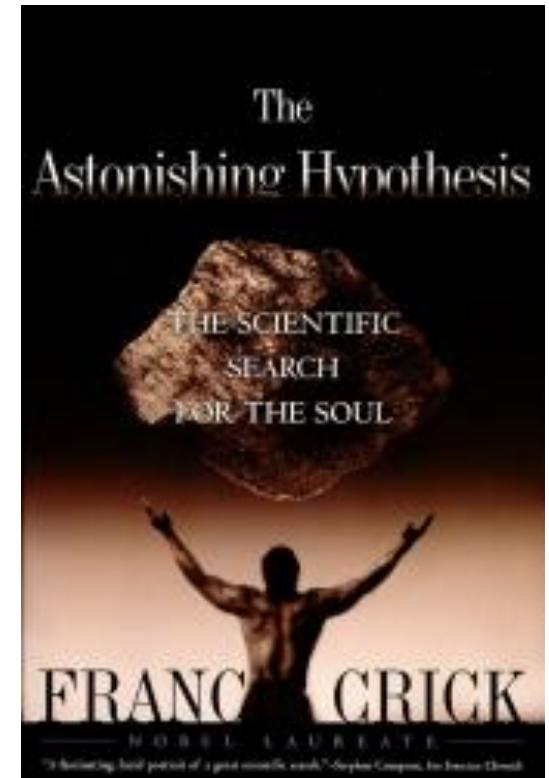


- “**You are your synapses.** They are who you are.”
- Neuroscientist Joseph LeDoux

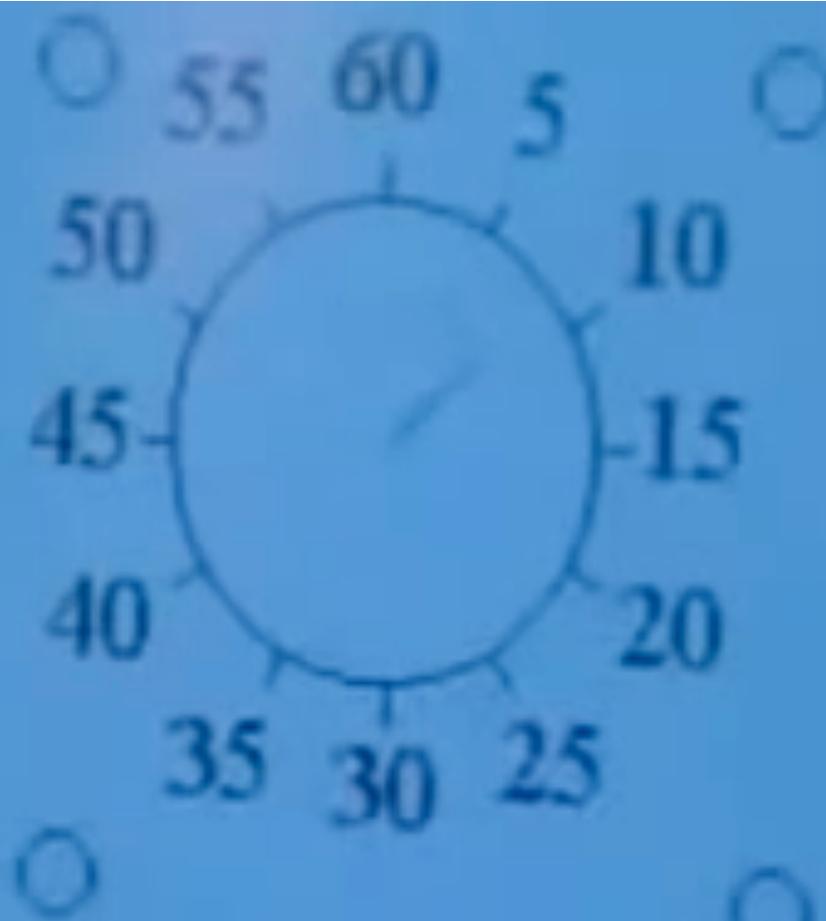
# Is Free Will an Illusion?

Considering our minds are ultimately nothing but neuro-chemical processes, free will may just be a grand illusion

Bargh: “this strong feeling [of free will] is an illusion, just as much as we experience the sun moving through the sky, when in fact it is we who are doing the moving”



# Libet (1983): the LAST Blow to Free Will?



# Libet (1983): the LAST Blow to Free Will

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“The brain started first, followed by the experience of conscious will, and finally followed by action.”

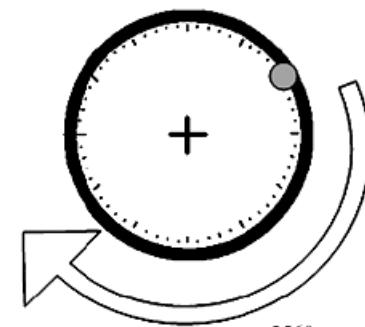
# Libet (1983): the LAST Blow to Free Will

investigated if brain activity involved in an action began before or after the decision to act e.g. if deciding to move your wrist **voluntary**, does the brain activity required to do this in the motor cortex start to happen before or after you make the ‘conscious’ decision to move your wrist.

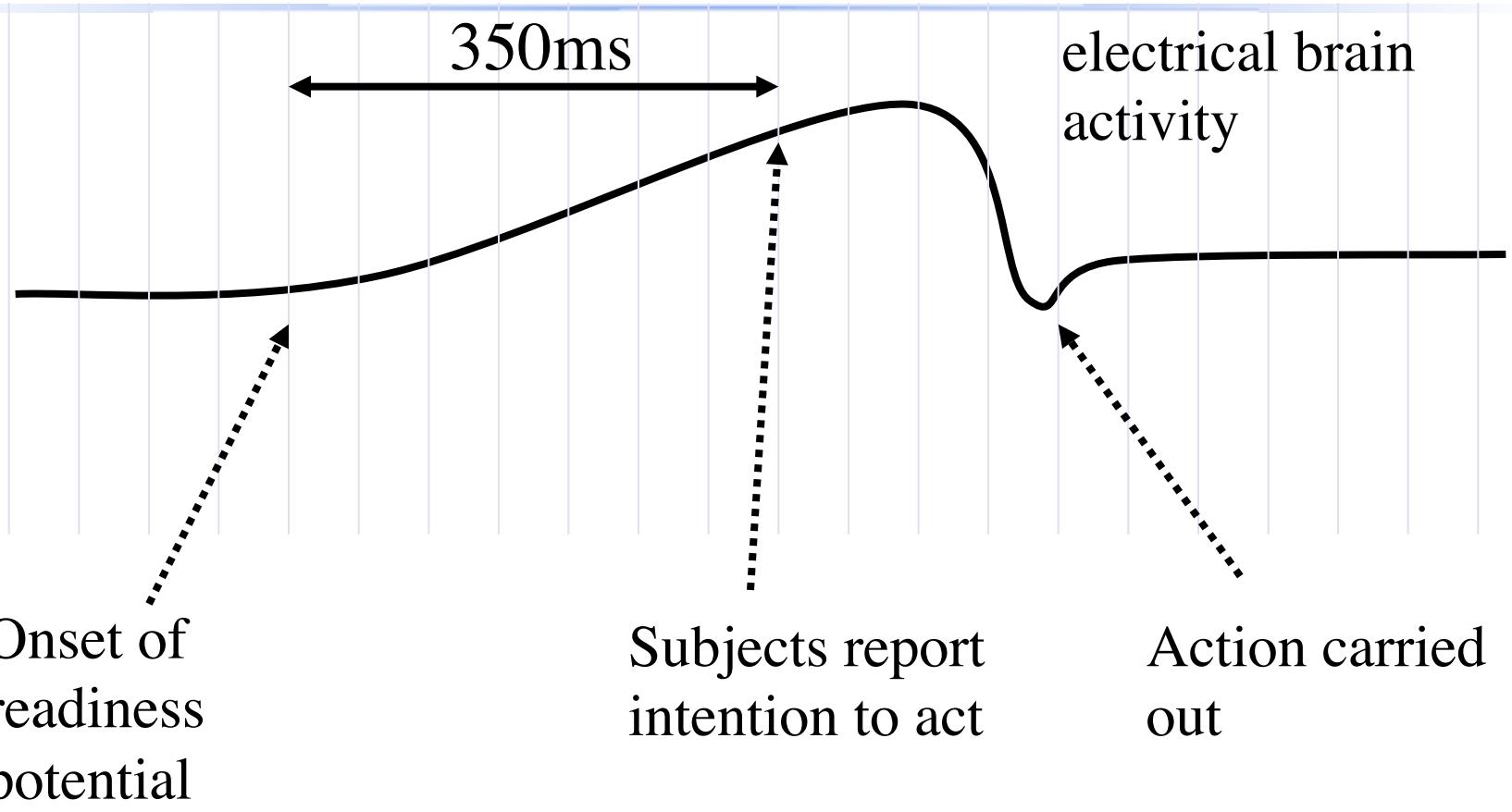


## 3 recordings of interest

- event related potentials (“readiness potentials” RP)
- conscious awareness of the voluntary action (with a clock)
- movement onset (electrical muscle activity using electrodes on the wrists)



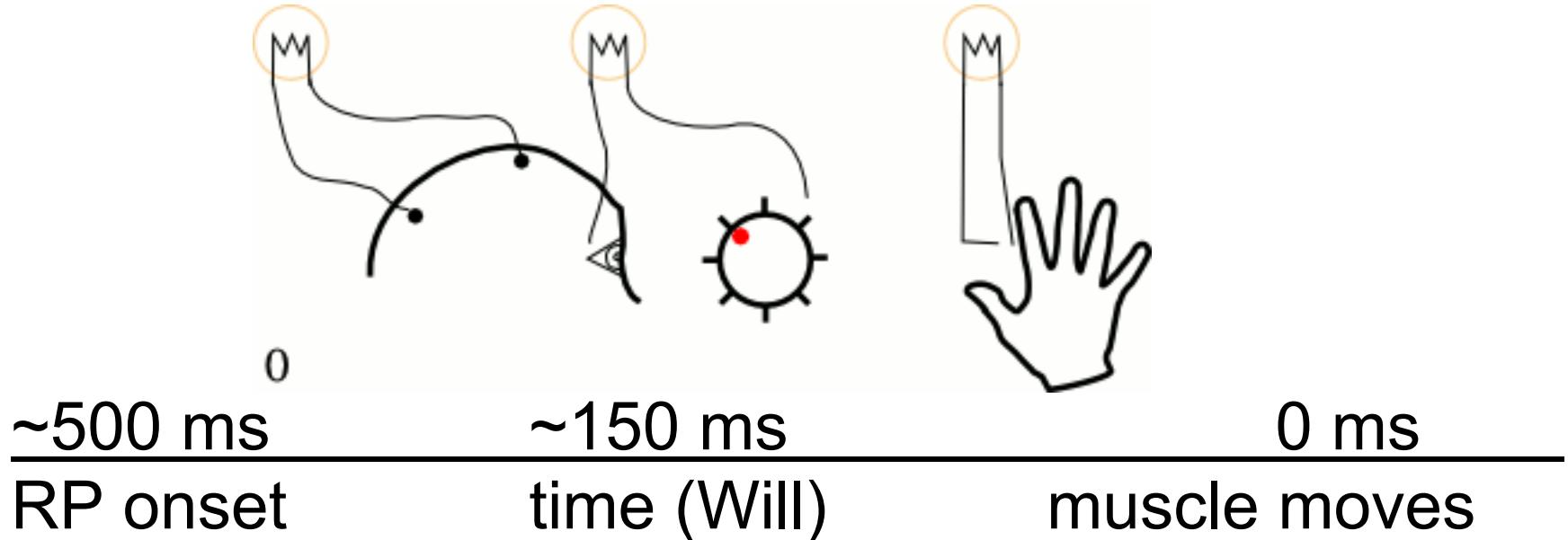
Wait for the will to act, press the button, and report the moment when the will arouse.



### Findings

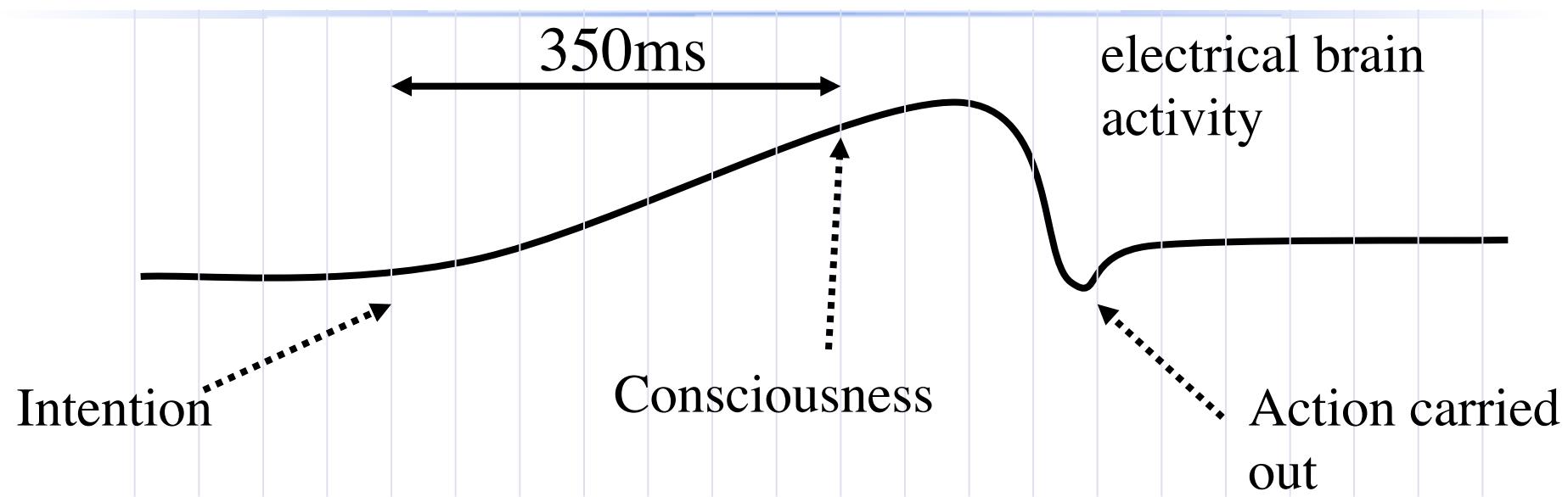
- Readiness potential in the brain occurred  $\sim 350\text{ms}$  before conscious awareness of the intention to move
- Conscious awareness occurred  $\sim 150\text{ms}$  before movement

# Libet Experiment (1983)



- “The brain ‘decides’ to initiate action... before there is any reportable subjective awareness that such a decision has taken place.”
- “Initiation of the voluntary process is developed unconsciously, well before there is any awareness of the intention to act”
- first movement is planned and then decision and awareness of that decision follows.

# Libet Experiment (1983): Alternative



- Consciousness requires neuronal adequacy to occur
- Subjective referral (time travel): after neuronal adequacy is reached, the event is referred back to the point at which it occurred
- Backward referral challenges NCC that consciousness equals certain brain activity
  - Believes data supports dualism

# Free Will May NOT be just an Illusion

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“Initiation of the voluntary process is developed unconsciously, well before there is any awareness of the intention to act”

- Libet, 1996, p112

Because conscious awareness happens before movement, it does have the opportunity to ‘veto’ the action

*“We don’t have free will, but we do have free won’t”*

- Gregory, 2003

# Essentials

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- Intro
  - Terri Schiavo, brain dead, conscious
  - Consciousness in PVS patients with fMRI
- Consciousness
  - What is consciousness and why is it a hard problem?
  - Dual aspect theory
- Free Will
  - Is free will an illusion according to determinism?
  - Libet & Hayens et al. Study: main findings and conclusions
- CogNeuro & Law
  - Legal implications of determinism
  - Neurolaw
    - Brain and antisocial behavior
    - Juveniles & Neuroscience